Space Weather Forecast

Issued on Saturday, 25 November 2023 at 13:13 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Isolated Moderate flares/R1-R2 Radio Blackouts likely throughout. Chance of Minor Geomagnetic Storms Days 1-2 (25-26 Nov).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with a peak Long Duration Event (LDE) Common-class flare from near the northern central disc at 24/2219 UTC. There are currently twelve sunspot groups on the visible disc, the majority of which are located in the eastern half of the solar hemisphere. Near centre disc in the northern hemisphere there is a cluster of four sunspot groups that appear to be contained within the same area of plage and magnetically connected. The largest group is a magnetically complex region in the southeast. One region in the southwest of the disc has shown recent growth and a slight increase in complexity. The other groups remain comparatively small and more magnetically simple.

A Coronal Mass Ejection (CME) observed on coronagraph imagery has been attributed to a Moderate flare that emerged from the region in the southwest of the disc at 24/0933 UTC. This CME has been analysed and modelled as a likely miss, with just a slight chance of a glancing blow on Day 3 (27 Nov). A second CME from the LDE Common-class flare late in the UTC day on 24 Nov may have produced a CME, however, there is only a very faint signal on available coronagraph imagery so it is assumed that much of the associated ejecta has been reabsorbed. No further Earth-directed CMEs have been observed in the period.

Solar Wind / Geomagnetic Activity: Solar wind parameters have been largely indicative of a background solar wind regime following the easing of a recent connection to a stream of fast winds from a coronal hole. Wind speeds were initially around 340 km/s, but since 24/1900 UTC increased gradually to 390-410 km/s. Following a discontinuity around 24/2300 UTC wind speeds increased to 470 km/s, and saw a more significant jump and minor discontinuity around 25/0800 UTC. This enhancement is indicative of a CME arrival at Earth, speculated to be from the arrival of the 22 Nov CME originating from the rupturing of a filament. The Interplanetary Magnetic Field was at Weak levels initially but increased to Moderate around 24/2230 UTC, with peaks at Strong levels following the arrival of the CME. The important north-south component varied weakly at first, but since the CME arrival has fluctuated more significantly and has been strongly southward since around 25/0600 UTC. The resultant geomagnetic activity was initially Quiet (Kp 1-2), but increased to Unsettled (Kp3) from 24/1800 UTC and has been at Active levels since the 25/0600-0900 UTC interval.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is expected with further isolated Moderate class flares and a slight chance of a Strong flare. The main flare risk is from regions currently positioned on the eastern solar hemisphere and from the cluster close to centre disc in the north. Despite this, the Moderate flare on 24 Nov originated from a relatively magnetically simple area in the southwestern disc.

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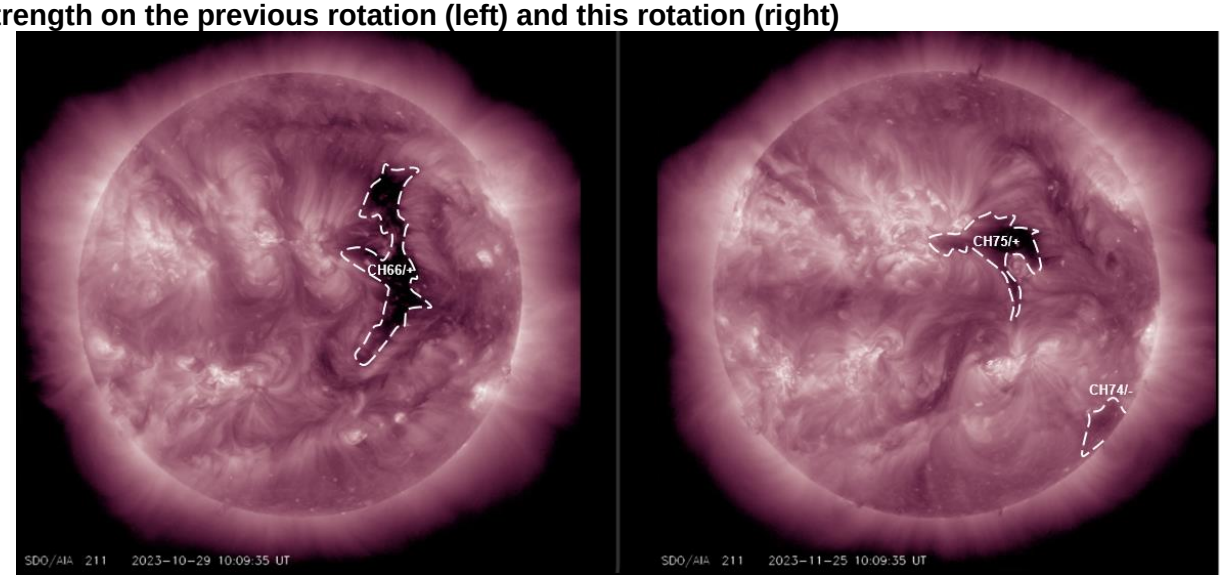
Solar Winds / Geomagnetic Activity: Two further Coronal Mass Ejections (CMEs) feature in the forecast period, with effects from a recent arrival expected to wane through Day 1 (25 Nov). A filament eruption CME observed from late 22 Nov is forecast to arriving either late Day 1, or more likely early Day 2 (26 Nov). A further CME resulting from the M1.1 flare from AR3499 on 24 Nov has been analysed and modelled as a likely miss, with just a slight chance of a glancing blow on Day 3 (27 Nov).

Solar winds are currently enhanced following the recent CME arrival and are around 550 km/s. Speeds may erratically decline to (or close to) Slightly Elevated levels later Day 1 as enhancement wanes. Further CME enhancement is anticipated on Day 2 (26 Nov), with more persistently Slightly Elevated speeds expected. The next significant coronal hole enhancement is expected to arrive through Day 2 (26 Nov) with the arrival of a HSS from CH75/+, giving speeds of 500-550 km/s (Elevated) that should broadly persist until the end of the forecast period.

Geomagnetic activity is expected to be initially Unsettled (Kp 3). Upon arrival of a CME late Day 1 (25 Nov) or early Day 2 (26 Nov) Active to G1/Minor Storm (Kp 4-5) conditions are probable. Combined CME and HSS influences may extend slightly enhanced Geomagnetic activity at Quiet to Unsettled levels (Kp 1-3) into Day 3 (27 Nov), but should subside to become mainly Quiet (Kp 0-2) Day 4 (28 Nov). Auroral enhancement is possible during the UTC nights of 25 and 26 Nov, and may be visible across parts of northern Scotland and similar latitudes.

Energetic Particles / Solar Radiation: No solar radiation storms are expected. However, there is a slightly higher risk of observing S1/Minor Storm conditions compared to normal, given the number of sunspots currently on the disc and their propensity to move into a more favourable location on the disc for connection with Earth in the coming days.

Figure 1: SDO/AI-211 imagery showing the difference between coronal hole positions and strength on the previous rotation (left) and this rotation (right)



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Met Office Space Weather Forecast

Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	50	50	10	1
Strong	G3	No	5	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	70	70	70	70
Very Active	R3 to R5 X	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	15	15
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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